Digital Instrumentation and Controls

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Acronyms

(excluding reactor identifiers)

COL	Combined Operating License
D3	Diversity and Defense-in-Depth
DOE	Department of Energy
FPGA	Field-Programmable Gate Array
I&C	Instrumentation and Controls
NRC	Nuclear Regulatory Commission
NRO	Office of New Reactor Licensing

Acronyms - continued

NRR	Office of Nuclear Reactor Regulation
NSIR	Office of Nuclear Safety and Incident Response
RES	Office of Nuclear Regulatory Research
SRP	Standard Review Plan

Agenda

- Background
- Licensing activities
- Technical issues
- Research activities
- Conclusions

Current Technology

Digital Technology

Digital I&C
Future Workload

- Operating reactor modifications
- Design Certification
- Combined Operating Licenses

Diversity and Defense-in-Depth (D3)

- Current approach
- Improving methods
- Acceptable level of D3
- Digital control room

Digital Risk Assessment

- Industry proposed D3 analysis
- NRC initiatives to update modeling
- Future activities

Highly Integrated Control Room

- Communication independence
  - between safety channels
  - safety to non-safety
- Control room design

Cyber Security

- Guidance for safety systems
- Industry guidelines
- Issue and resolution

Infrastructure Development

- Updates to guidance
- Recruiting
- Training
- External contacts

Digital System Research

- Comprehensive research plan
- 27 research projects that support program offices
- Products include technical review guidance and acceptance criteria
- Research supports current and future reactor key issues

Diversity and Defense-in-Depth (D3)

- Knowledge and technology has evolved
- Complex process to consider diversity attributes
- Develop combinations of D3 strategies

Digital Risk Assessment

- I&C licensing process is deterministic
- Developing modeling methods
- Other industries have used reliability and risk methods
- Goal is to establish a risk-informed review method

Highly Integrated Control Room

- Will provide licensing guidelines
  - Safety channel communications
  - Safety to non-safety system displays and controls
- Will develop review criteria

Cyber Security

- Cyber security assessments
  - Evaluating potential vulnerabilities
  - Safety system assessments
  - Safety to non-safety connections

Additional Research Areas

- Alternatives to micro-processor technology
  - Field Programmable Gate Array (FPGA) based technology
  - Develop review guidance
- On-line Monitoring
  - Provide guidance on analytical methods and uncertainty

Conclusions

- Evolving digital technology is a challenge from a regulatory perspective
- We are working closely with stakeholders to update guidance
- Leverage other sources
- Working to have the right people and procedures to license digital systems